

CLAIMS

We claim:

1. A material handling vehicle comprising:
 - an operator compartment;
 - a first control handle mounted to the operator compartment for access by an operator facing a first direction for producing a first travel request control signal;
 - a second control handle mounted to the operator compartment for access by an operator facing a second direction for producing a second travel request control signal;
 - a traction control system for driving the material handling vehicle in a selected direction and at a selected speed; and
 - a vehicle control system for receiving the first and second travel request control signals and for producing and transmitting a directional control signal and a speed control signal to the traction control system, wherein the vehicle control system evaluates the first and second travel request control signals, determines whether a conflict exists between the first and second travel request control signals, and brings the vehicle to a stopped state when the conflict exists.
2. The material handling vehicle as defined in claim 1, wherein the first and second control handles are each rotatable to produce control signals between a neutral and a non-neutral position.
3. The material handling vehicle as defined in claim 2, wherein when one of the first and second control handles is in the neutral position, the vehicle control system commands the

vehicle to move in the direction and at the speed of the control signal of the other of the first and second control handles.

4. The material handling vehicle as defined in claim 2, wherein the vehicle control system determines that a conflict exists when neither of the first and second control handles is in the neutral position.

5. The material handling vehicle as defined in claim 1, further comprising a vehicle direction feedback system connected to the vehicle control system.

6. The material handling vehicle as defined in claim 5, wherein the vehicle control system compares the vehicle direction signal to the requested direction of motion and reverses the motor to slow the vehicle when the vehicle direction is opposite of the requested direction.

7. A method for controlling a material handling vehicle having a first and a second control handle, the method comprising the following steps:

a. monitoring a control signal from each of the first and second control handles to determine whether the control handle is in a neutral position or a non-neutral position;

b. determining a requested direction of travel and a requested speed for each control handle in a non-neutral position;

c. commanding the vehicle to travel in the selected direction and at the selected speed when one of the first and second control handles is in the non-neutral position and the other of the first and second control handles is in the neutral position; and

d. driving the vehicle to a stopped state when both the first and the second control handles are in the non-neutral position.

8. The method as defined in claim 7, wherein step b further comprises:
monitoring an actual speed and an actual direction of travel of the vehicle;
comparing the selected direction of each non-neutral command signal to the actual direction of travel;
categorizing requests to travel in the actual direction of travel or from a stopped state as a drive request to continue motion in the selected direction; and
categorizing requests to travel in the direction opposite to the direction of travel as a plug request to slow the material handling vehicle.

9. The method as defined in claim 8, wherein step d further comprises the steps of:
determining whether the request from each of the first and second control handles is a plug request or a drive request; and
slowing the vehicle to a stopped state when either of the first and second control handles is producing a plug request.

10. The method as defined in claim 9, wherein step d further comprises the step of driving the material handling vehicle at the slower of the speed requests from the first and the second control handles when both of the first and second control handles are providing a drive request.

11. The method as defined in claim 9, wherein step d further comprises the step of delaying until both the first and second control handles are returned to a neutral position

before commanding the vehicle to move based on input from either of the first and the second control handles.

12. The method as defined in claim 10 wherein step d comprises slowing the vehicle to a stop when one of the first and second handles providing a drive command is returned to a neutral position.

13. A method for resolving conflicting inputs from each of a first and a second control handle in a material handling vehicle, the method comprising the following steps:

- a. monitoring a first input command from the first control handle for a first speed and a first direction of travel command signal;

- b. monitoring a second input command signal from the second control handle for a second speed and a second direction of travel command signal;

- c. monitoring the actual direction of motion and actual speed of the vehicle;

- d. comparing each of the first and second command signals to a neutral position and to the actual direction of motion to determine whether each of the first and second command signals is a drive request, a plug request, or a neutral request; and

- e. when one of the first and second control signals is a neutral request and the other is a drive request or a plug request, commanding the material handling vehicle to follow the command of the other control handle;

- f. when each of the first and the second control signals is a drive request, commanding the material handling vehicle to drive at the lower of the first and second speed commands until either of the control signals is changed to a plug request or a neutral request and then coasting the vehicle to a stopped state;

g. when neither of the first and second signals is a neutral request and at least one of the first and second control signals is a plug request, commanding the material handling vehicle to slow to the stopped state.

14. The method as defined in claim 13, wherein step g, further comprises the steps of:

i) slowing the vehicle at a predetermined deceleration rate when one of the first and second control signals is a plug request and the other is a drive request; and

ii) slowing the vehicle at the faster of the first and second plug request deceleration rates when both of the first and second control signals are a plug request.

15. The method as defined in claim 13, further comprising the step of:

h. commanding the vehicle to remain in the stopped state until the first and second control signals are each in the neutral state.

16. The method as defined in claim 13, wherein step g comprises:

i) commanding the vehicle to remain in the stopped state until at least one of the first and second handles is returned to the neutral state; and

ii) commanding the vehicle to move at the speed and in the direction selected by the control handle returned to the neutral state when the handle is moved out of the neutral state to provide a drive request.

17. The method as defined in claim 16, wherein step (ii) comprises the step of limiting the speed of the vehicle to a pre-selected maximum.

18. The method as defined in claim 13, wherein step g further comprises comparing the actual speed of the vehicle to zero and entering the stopped state when the actual speed is substantially equivalent to zero.

19. A method for controlling a lift truck having a first control handle facing the fore direction and a second control handle facing the aft direction, the method comprising the following steps:

a. monitoring a first travel request signal from the first control handle providing a first speed and a first direction of travel control signal;

b. monitoring a second travel request signal from the second control handle providing a second speed and a second direction of travel control signal;

c. comparing each of the first and second travel request signals to a neutral request signal associated with a neutral control handle position and determining whether each of the first and second travel request signals is a neutral request signal or a non-neutral request signal; and

d. when one of the first and second travel request signals is a neutral request signal and the other is a non-neutral request signal, operating the lift truck in a normal mode wherein the lift truck follows the non-neutral request signal;

e. when neither of the first and second control signals is a neutral control signal, operating the lift truck in a conflict mode wherein the lift truck is controlled to a stopped state; and

f. after the lift truck is in the conflict mode, allowing the lift truck to enter the normal mode of operation only if both of the first and second control signals are returned to a neutral request signal while the vehicle is in the stopped state.

20. The method as defined in claim 19, wherein step c further comprises the steps of:
monitoring an actual direction of motion of the vehicle;
comparing the direction of the each non-neutral travel request signal to the actual direction of motion; and
categorizing the travel request as a plug request when the direction of the travel request is the opposite of the actual direction of travel of the vehicle and as a drive request when the direction of the travel request is in the same direction as the actual direction of the vehicle.

21. The method as defined in claim 20, wherein step e further comprises the step of driving the vehicle at the lower of the first and second speed requests when each of the first and second travel requests is a drive request.

22. The method as defined in claim 20, wherein step e further comprises the step of slowing the vehicle at the higher of the first and second speed requests when each of the first and second travel requests is a plug request.

23. The method as defined in claim 20, wherein step e further comprises the step of slowing the vehicle at a pre-defined deceleration rate when one of the first and second travel requests is a drive request and the other of the first and second travel requests is a plug request.

24. The method as defined in claim 21, further comprising the step of commanding the vehicle to coast to a stop when either of the first and second travel requests is changed to either a neutral request or a plug request.

25. The method as defined in claim 20, wherein step f further comprises the steps of
monitoring the first and second travel requests to determine if one has returned to the
neutral position;
commanding the vehicle to drive at a limited pre-selected maximum speed in the
direction selected by the travel request that had returned to a neutral request when the travel
request moves to a non-neutral position.